Space Weather Technical Forecast

Issued on Friday, 05 July 2024 at 13:12 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares throughout.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Moderate with two M-class flares in the past 24 hours, an M1.0 flare at 04/1425 UTC and an M1.4 flare at 04/2005UTC, both from AR3730 which is no longer visible due to it rotating around the western limb.

There are ten sunspot regions on the disc. The main changes in the period have been continued penumbral areal growth in AR3733 in the northwest, with a weak delta spot now visible in the southern portion of the trailing group. AR3729 remains a relatively open F-group, with some proliferation of intermediate and trailing spots. AR3636 has also shown recent growth. A new region rotating around the eastern limb is showing signs of being a larger group, but needs to rotate further onto the visible disc for accurate analysis to take place. All other groups were apparently stable or weakening.

No Earth-directed Coronal Mass Ejections (CMEs) have been observed in imagery during the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds as observed by ACE at L1 were at Background levels, generally between 330-370 km/s. The solar wind density rose to above average levels, peaking at 19 pccc at 05/0227 UTC, before declining back to below average levels. The Interplanetary Magnetic Field (IMF), Bt, was largely weak to moderate, peaking just shy of 12 nT around 05/0530 UTC. The north-south component, Bz, was negatively (southward) deflected for a while, but has since become generally positive (northward), ranging over the whole period between +9 and -9 nT. The phi angle was mainly positive (away from the Sun). Geomagnetic activity was Quiet-Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at Background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was initially at moderate levels, but slowly decayed back to background through the period. The 24-hour fluence remained below Active on a declining trend, with 9.6e6 integrated pfu observed at 05/0001UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: There is a flat daily Chance of further isolated M-class flares, perhaps most likely from AR3733. Upcoming sunspot region arrivals over the eastern solar horizon in the period should help compensate for western limb losses.

Solar Wind / Geomagnetic Activity: No CMEs feature in the forecast.
Geomagnetic activity is expected to persist as Quiet to Unsettled (Kp0-3) through the next four days, with the greatest chance of departure from this being over the UTC weekend, with a Slight Chance of isolated Active (Kp4) intervals due to a possible connection to a small northern coronal hole.

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Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at Background levels.

High energy electron flux is most likely to peak at Moderate levels over the coming days with a gradual decreasing trend, and only a Slight Chance of reaching Active electron fluence.

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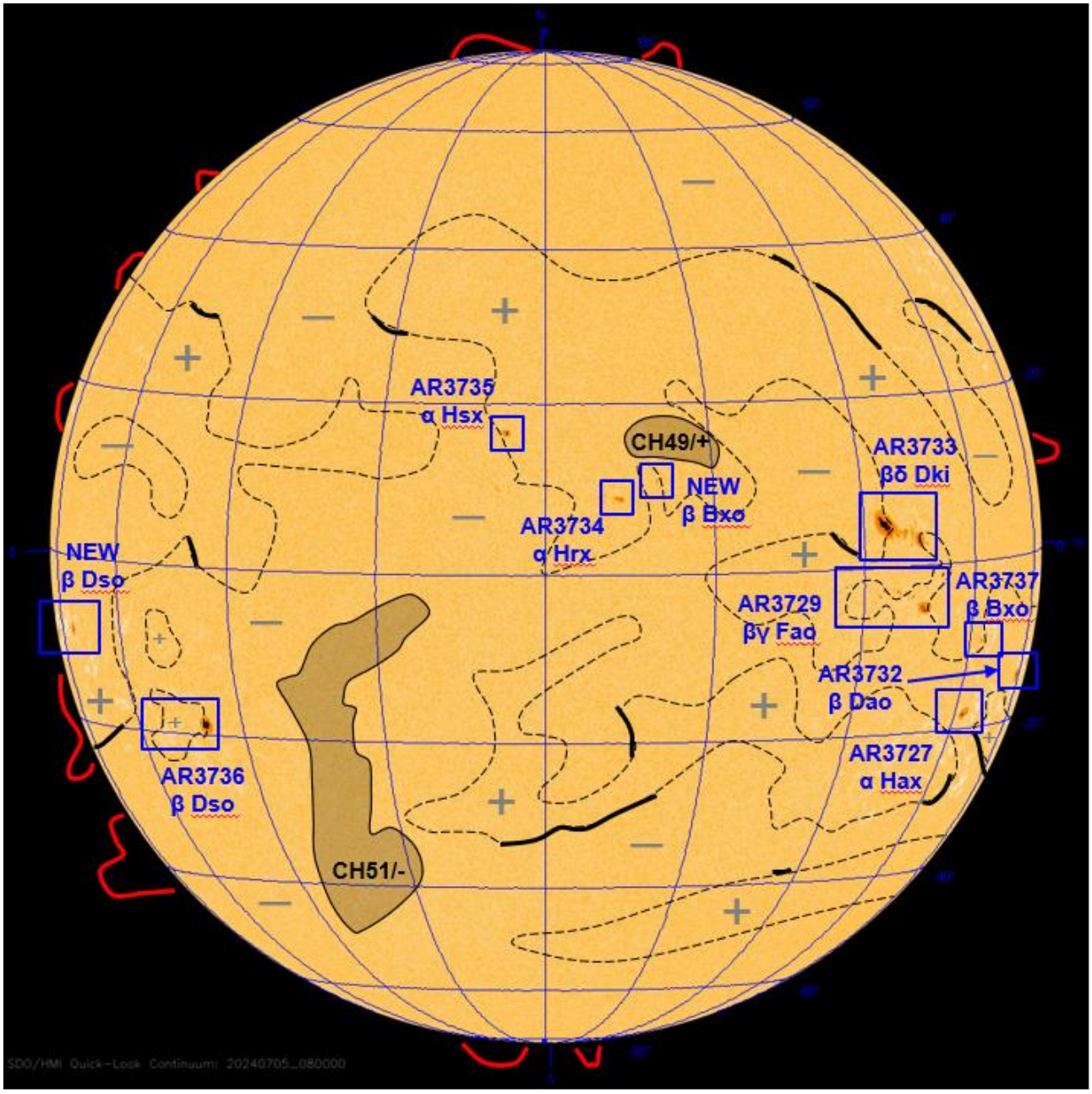
Figure 1. Solar Analysis Valid 05/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs feature in the forecast.

In the likely absence of any CME arrival, the solar wind may now follow a slow regime throughout the four-day period. The main uncertainty in this regard is a returning but now very tenuous coronal hole (CH49/+ in the northwest). This has apparently further closed in EUV (e.g. AIA211) in the past 36-hour period, being increasingly eclipsed by bright flux to its east. Even with this trend, the emanating and potentially Earth-affecting solar wind from CH49/+ will have departed prior to this occurring and this is the basis for maintaining a small chance of slightly elevated or perhaps elevated wind speeds either late Day 2 or early Day 3 (06 or 07 Jul).

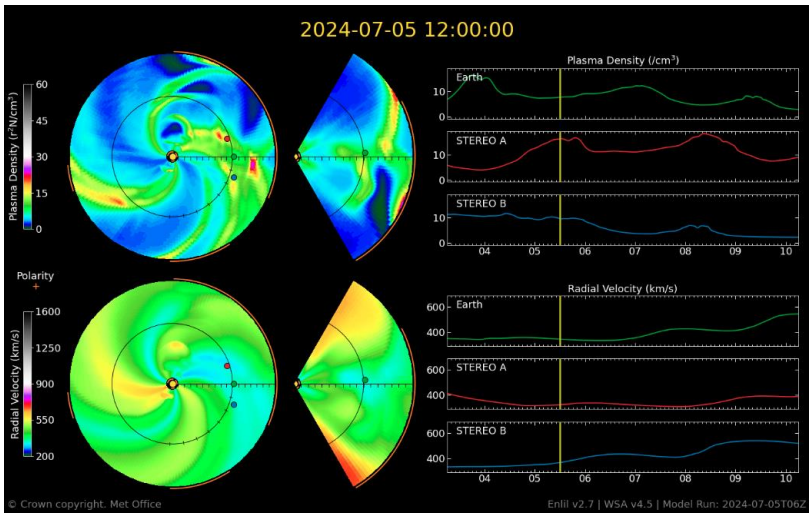
Geomagnetic activity is expected to persist as Quiet to Unsettled (Kp0-3) through the next four days, with the greatest chance of departure from this being over the UTC weekend, with a Slight Chance of isolated Active (Kp4) intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity – Earthbound Coronal Mass Ejections

No Earth-directed CMEs are expected.

Figure 2: MOSWOC Enlil model looks to be providing good guidance currently. A possible connection to CH49/+ is hinted at on Days 2/3 (06-07 Jul).



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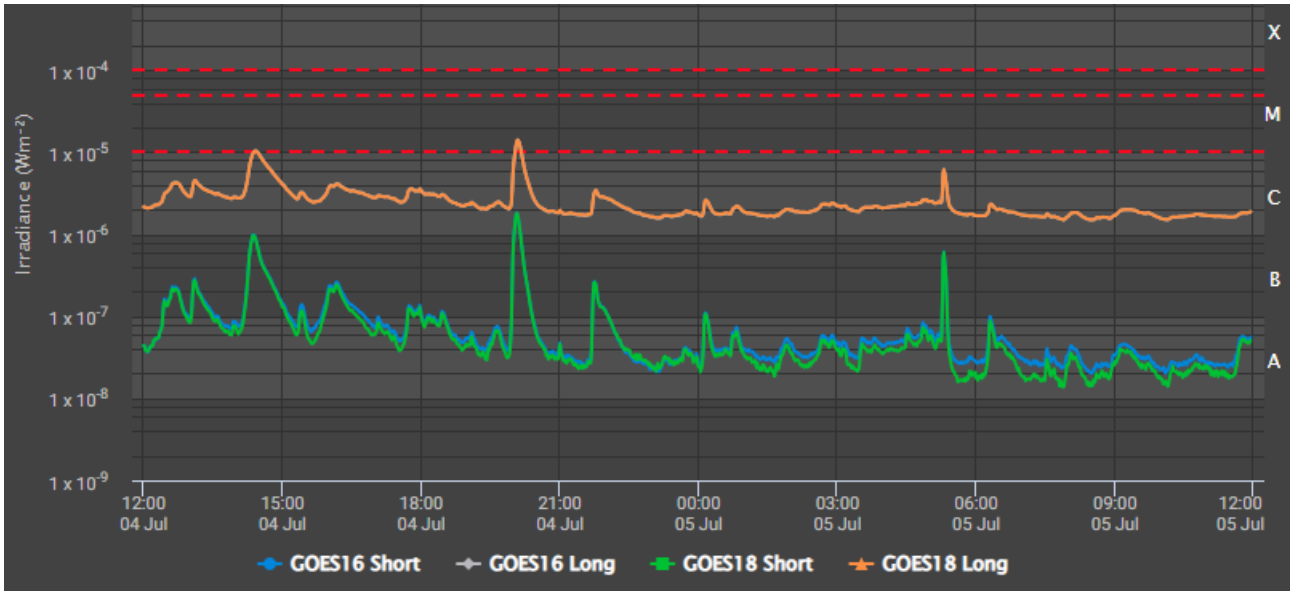
Radio Blackouts - X-Ray Flares:
There are ten sunspot regions on the disc. The main change in the period has been the continued penumbral areal growth in AR3733 in the northwest, with a weak delta spot now visible in the southern portion of the trailing group. AR3729 in the southwest remains a relatively open F-group, with some proliferation of intermediate and trailing smaller spots. AR3636 in the southeast has shown recent growth as it rotates further into view. The new, as yet unnumbered, region rotating around the eastern limb appears to be a larger group consisting of multiple spots, but full analysis will continue to be tricky until it rotates further onto the visible disc. All other groups were apparently stable or weakening.

The recent growth in AR3733 is the main rationale for maintaining the daily 40% Chance of M-class activity, despite the fact that the two M-flares sense in the past 24 hours originated from AR3730 which is no longer visible due to it rotating around the western limb. Expected upcoming sunspot region arrivals over the eastern solar horizon in the period should help compensate for western limb losses.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16 & -18 X-ray flux.



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Solar Radiation Storms - (High Energy Protons):
There has been little recent response in GOES18 high energy proton flux measurements to low-level M-class flares of late. However many of the more complex sunspot regions on the disc are now nearing the better-connecting western portion of the disc, leading to a Slight Chance of S1 or greater as these groups round the western limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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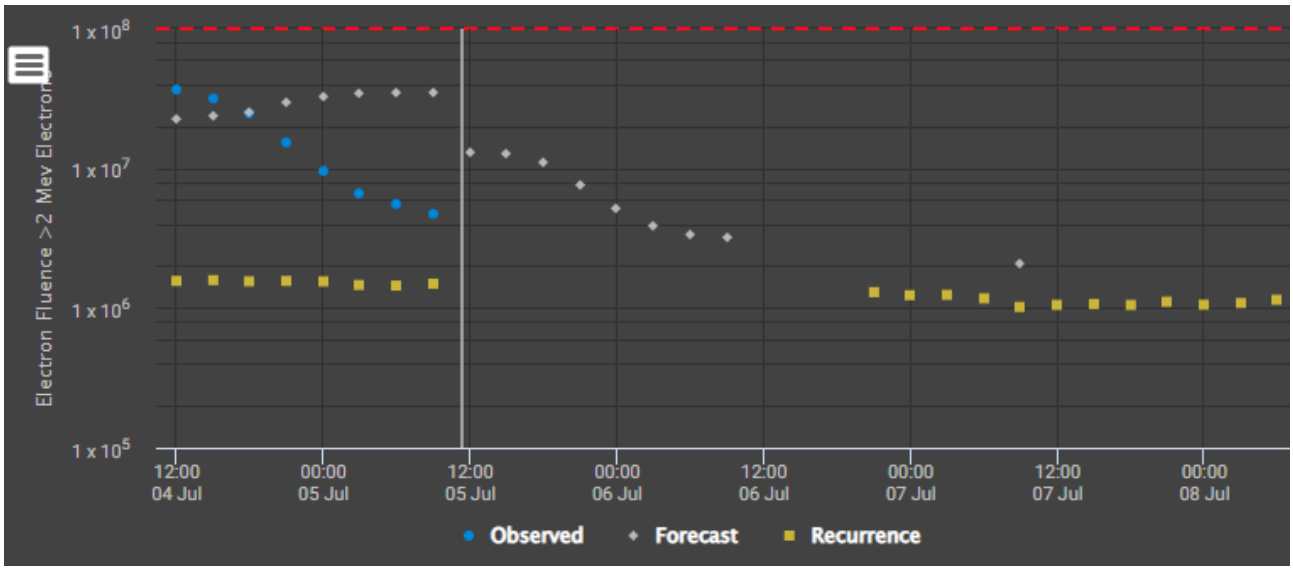
High Energy Electrons Event (≥ 2MeV):
The new calendar month has seen a day-on-day rise in high energy electron flux recorded at GOES16, although the current diurnal trend appears to show that this has saturated at mainly Moderate to background levels.

With the strong possibility of no further drivers for increasing electron populations in the period, the most probable evolution is for a slow erosion of the current GOES16 trace in the slow solar wind environment. The main question mark as to this continuing is the possible presence of CH49/+ over the UTC weekend, with uncertainty increasing as levels perhaps take a temporary dip at GEO, with an uncertain but probably muted recovery in fluence into the new UTC working week. The MOSWOC REFM general trend for a continued reduction is considered good guidance, albeit the recent reduction has occurred earlier than REFM would suggest.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	5
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: MOSWOC REFM showing a general downward trend in electron fluence is expected.



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